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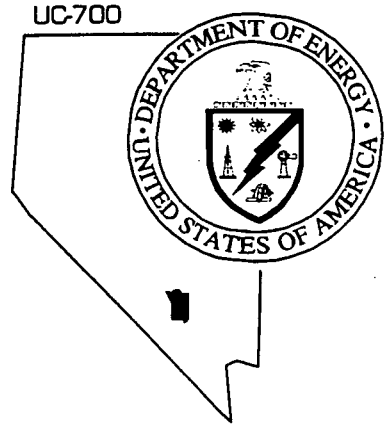

Rulison Site
Groundwater Monitoring Report
Third Quarter, 1997

October 1997

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Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

DOE/NV-460
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RULISON SITE
GROUNDWATER MONITORING REPORT
THIRD QUARTER, 1997

DOE Nevada Operations Office
Las Vegas, Nevada

October 1997

RULISON SITE
GROUNDWATER MONITORING REPORT
THIRD QUARTER, 1997

Approved by: _____ Date: 10/23/97
Pete Sanders, Acting Project Manager
Off-Sites Subproject

Approved by: _____ Date: 10/23/97
Michael O. Giblin, Acting Project Manager
Nevada Environmental Restoration Project

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List of Acronyms and Abbreviations

AEC	U.S. Atomic Energy Commission
Austral	Austral Oil Company
BTEX	Benzene, toluene, ethylbenzene, and xylenes
COPC	Constituent(s) of potential concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	Foot (feet)
H_2SO_4	Sulfuric acid
HCl	Hydrochloric acid
HNO_3	Nitric acid
km	Kilometer(s)
LTGMP	Long-Term Groundwater Monitoring Plan
m	Meter(s)
mi	Mile(s)
mL	Milliliter(s)
MS/MSD	Matrix spike/matrix spike duplicate
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*
RPD	Relative percent difference(s)
SGZ	Surface ground zero
TPH	Total petroleum hydrocarbons
TDS	Total dissolved solids
TSS	Total suspended solids
µg/L	Microgram(s) per liter
VOC	Volatile organic compound
°F	Degree(s) Fahrenheit

1.0 Introduction

This report summarizes the results of the third quarter 1997 groundwater sampling event for the Rulison Site, which is located approximately 65 kilometers (km) (40 miles [mi]) northeast of Grand Junction, Colorado. The sampling was performed as part of a quarterly groundwater monitoring program implemented by the U.S. Department of Energy (DOE) to monitor the effectiveness of remediation of a drilling effluent pond located at the site. The effluent pond was used for the storage of drilling mud during drilling of the emplacement hole for a 1969 gas stimulation test conducted by the U.S. Atomic Energy Commission (AEC) (the predecessor agency to the DOE), and Austral Oil Company (Austral).

1.1 Site Location

The Rulison Site is located in the North ½ of the Southwest ¼ of Section 25, Township 7 South, Range 95 West of the 6th Principal Meridian, Garfield County, Colorado, approximately 19 km (12 mi) southwest of Rifle, Colorado, and approximately 65 km (40 mi) northeast of Grand Junction, Colorado (Figure 1-1). The site is situated on the north slope of Battlement Mesa on the upper reaches of Battlement Creek, at an elevation of approximately 2,500 meters (m) (8,200 feet [ft]). The valley is open to the north-northwest and is bounded on the other three sides by steep mountain slopes that rise to elevations above 2,927 m (9,600 ft).

1.2 Project Description and Background

Project Rulison, a joint AEC and Austral experiment, was conducted under the AEC's Plowshare Program to evaluate the feasibility of using a nuclear device to stimulate natural gas production in low-permeability, gas-producing geologic formations. The experiment was conducted on September 10, 1969, and consisted of detonating a 40-kiloton nuclear device at a depth of 2,568 m (8,426 ft) below ground surface. Natural gas production testing was conducted in 1970 and 1971.

The site was deactivated by the AEC and Austral in 1972 and abandoned in 1976. Cleanup associated with site abandonment consisted of removing all remaining equipment and materials, plugging the emplacement (R-E) and reentry (R-EX) wells (Figure 1-2), backfilling the mud pits adjacent to the R-EX well, removing the tritium-contaminated soils, and conducting extensive surface soil sampling and analysis to characterize the radiological condition of the site.

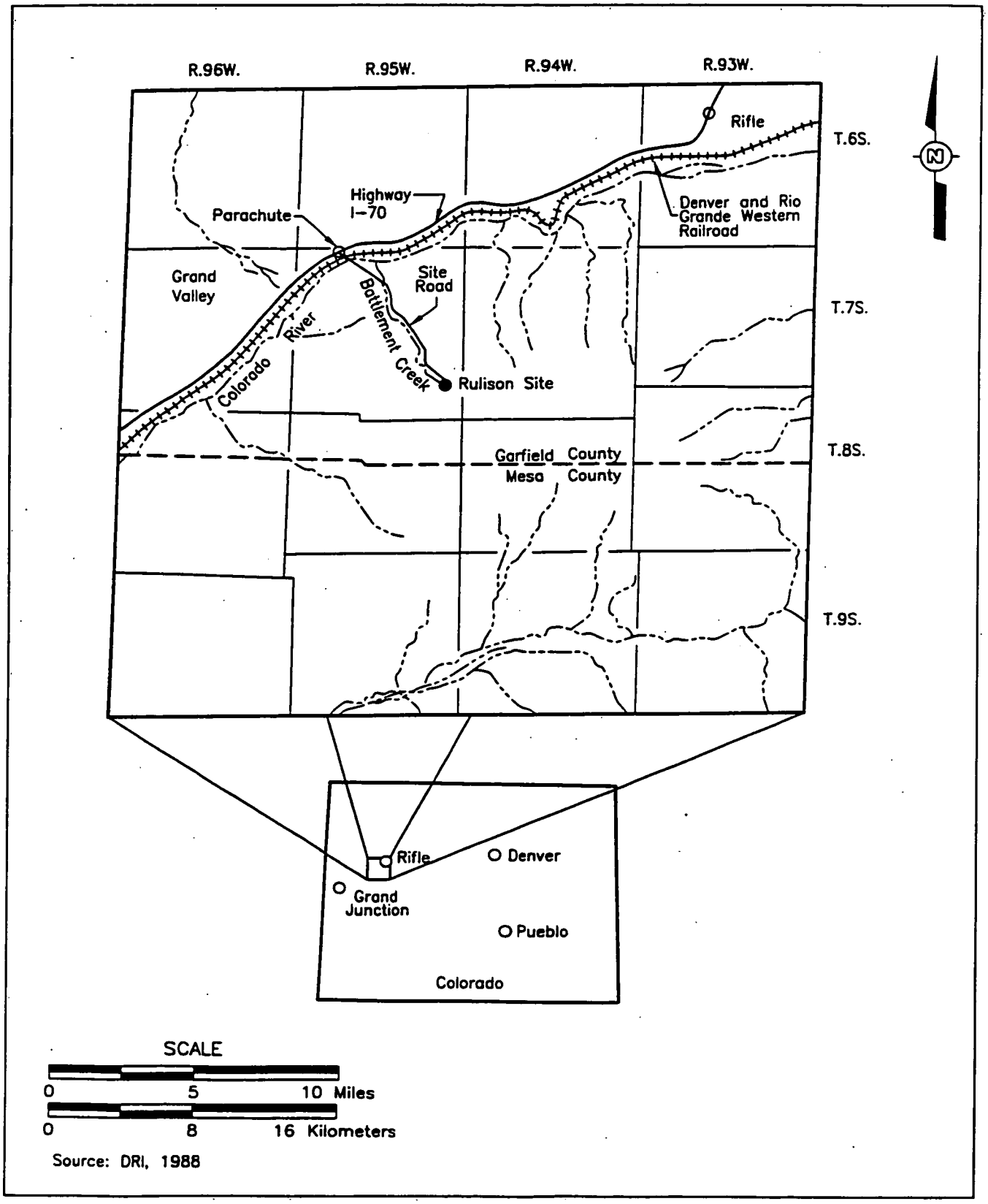

Figure 1-1
Rulison Site Location Map

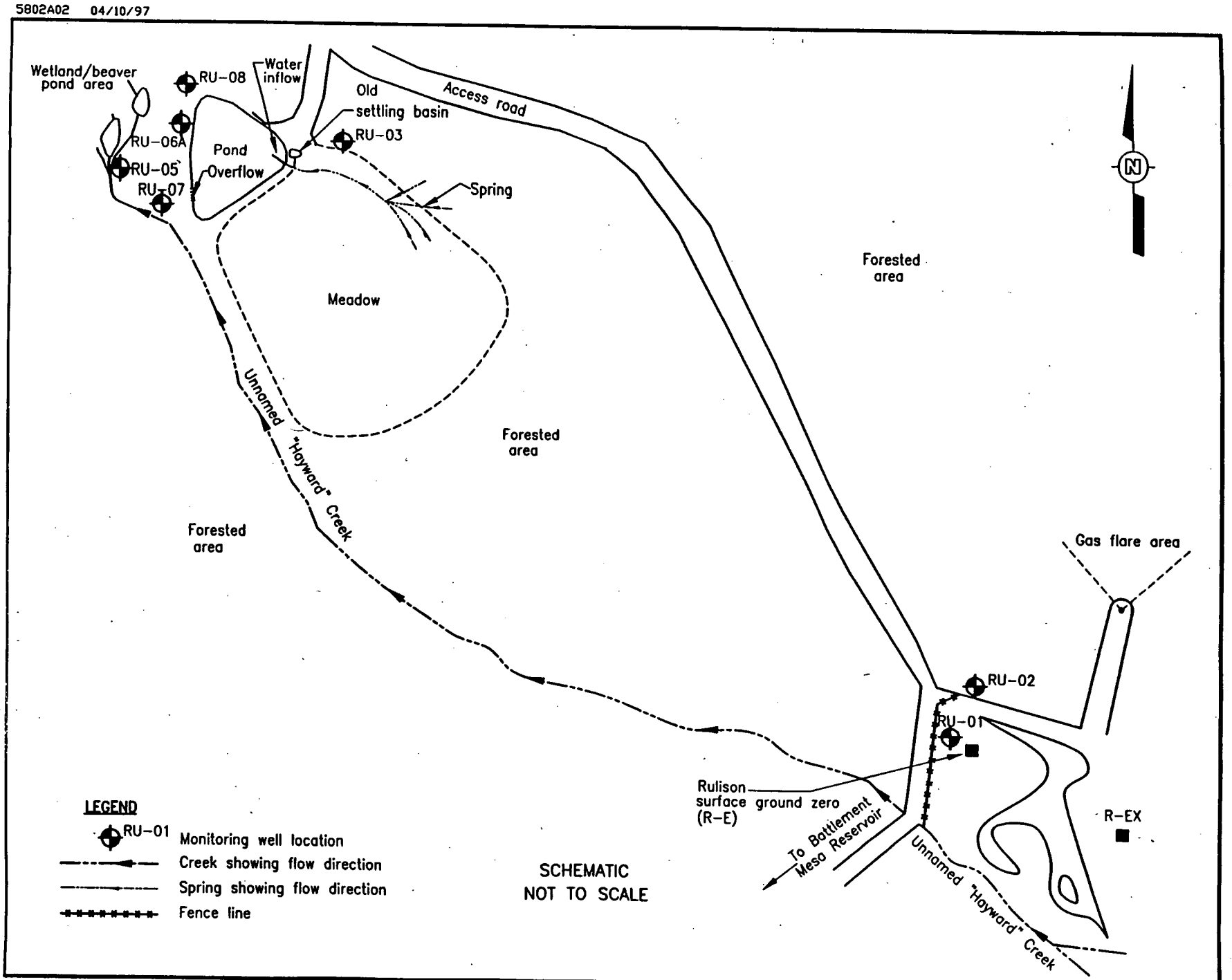

Figure 1-2
Monitoring Well Locations

Detailed descriptions of the site deactivation and abandonment activities and radiological characterizations are presented in the *Rulison Site Cleanup Report* (AEC, 1973), the *Project Rulison Well Plugging and Site Abandonment Final Report* (ERDA, 1977), and the *Rulison Radiation Contamination Clearance Report* (Eberline, 1977).

The drilling effluent pond is an engineered structure located approximately 400 m (1,312 ft) north-northwest of the surface ground zero (SGZ) emplacement well (R-E) (Figure 1-2). The pond covers approximately 0.5 hectare (1.2 acres) as measured at the top of the berm; it is triangular in shape; and it is approximately 6 m (20 ft) deep from the top of the berm to the pond bottom. The drilling effluent pond was used to store nonradioactive drilling fluids generated during drilling of the device emplacement Well R-E. The drilling fluids consisted of bentonite drilling mud that contained various additives, such as diesel fuel and chrome lignosulfonate, used to improve drilling characteristics. Most of the drilling wastes were removed from the pond when the site was cleaned up and decommissioned in 1976; however, some drilling fluid was left in the pond. At the request of the property owner, the pond structure was left in place following completion of site decommissioning and was subsequently converted by the property owner to a freshwater holding pond containing aquatic vegetation, amphibians, and stocked rainbow trout.

In 1994 and 1995, four pond sediment sampling events were conducted to evaluate the extent of residual contamination from drilling wastes remaining in the pond. Concentrations of diesel-range total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene, and total xylenes (BTEX compounds); barium; chromium; and lead were found in pond sediment samples and soil samples taken from an old settling basin located adjacent to the pond. Based on the results of the 1994 and 1995 sampling events, the DOE decided to conduct a voluntary cleanup action at the pond to reduce the levels of TPH and chromium in pond sediments and soils in and adjacent to the pond. The cleanup was completed in November 1995. One upgradient monitoring well (RU-03 on Figure 1-2) and four downgradient monitoring wells (RU-05, RU-06A, RU-07, and RU-08) were installed around the pond to monitor the effectiveness of the cleanup. A detailed description of pond cleanup and well installation is presented in the *Rulison Site Corrective Action Report* (DOE, 1996b).

1.3 Summary of Site Activities

The third quarter 1997 sampling event was conducted on August 21, 1997, by personnel from IT Corporation representing the U.S. Department of Energy, Nevada Operations Office. Four out of the five wells scheduled for sampling had a sufficient volume of water to be sampled. The weather was partly cloudy and the temperatures were generally in the 70° degrees Fahrenheit (°F) with light winds. There was a brief afternoon rain shower that occurred between sampling wells. No other unusual observations were made.

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2.0 Sampling and Analysis Procedures

The third quarter 1997 groundwater sampling event was conducted in general accordance with the *Rulison Drilling Effluent Pond Site Long-Term Groundwater Monitoring Plan* (LTGMP) (DOE, 1996a) and the *Rulison Site Quality Assurance Project Plan, Rulison Site, Colorado* (QAPP) (DOE, 1996c).

2.1 Groundwater Level Measurement

Before purging and sampling activities at each well began, the depth to groundwater and total depth of the well were measured. This information was used to calculate the appropriate purge volume and to allow evaluation of any potential changes to groundwater flow direction since the previous sampling event.

2.2 Well Purging

Monitoring wells were purged of stagnant groundwater using disposable bailers. The pH, temperature, and conductivity of the groundwater were taken prior to discharging any water to the surface and at regular intervals thereafter. The pH values ranged from 6.86 to 7.42. The purge water was discharged to the ground under Colorado Wastewater Discharge Permit No. COG-310084 as approved by the Colorado Department of Public Health and Environment, Water Quality Control Division (see Appendix A).

2.3 Sample Collection and Handling

Groundwater samples were collected from Wells RU-03, RU-05, RU-06A and RU-08 with disposable bottom-emptying bailers. For quality control (QC) purposes, one duplicate sample, one matrix spike/matrix spike duplicate (MS/MSD), and an equipment rinse blank sample were collected during the sampling event. In addition, a trip blank accompanied all volatile organic samples in their shipping container. Samples were containerized and preserved as specified in Table 2-1. All containers were certified clean by the laboratory and remained sealed until ready for use.

2.4 Sample Analysis

The groundwater samples from the third quarter 1997 sampling event were analyzed for the parameters listed in Table 2-1, as specified in the Rulison LTGMP (DOE, 1996a). These

parameters included the constituents of potential concern (COPCs) identified for the drilling effluent pond sediments (TPH, BTEX, chromium, iron, zinc, and lead).

Table 2-1
Rulison Site Groundwater Monitoring Program
Sample Container, Preservation, and Analytical Requirements

Parameter	Analytical Method	Sample Container	Minimum Amount of Sample Required	Holding Time	Preservative[a]
BTEX	SW-846[b] 8020A	Glass with Teflon™- lined cap	3 x 40 mL	14 days	pH <2 with HCl Cool to 4°C
TPH (diesel fraction)	SW-846 8015M[c]	Amber Glass	1 liter	14 days	pH <2 with H_2SO_4 Cool to 4°C
RCRA[d] Metals	SW-846 6010/ 7470A	Polyethylene	1 liter	180 days	HNO_3 to pH <2 Cool to 4°C, unfiltered
Total Dissolved Solids (TDS)	EPA 160.1[e]	Polyethylene	100 mL	7 days	Cool to 4°C
Total Suspended Solids (TSS)	EPA 160.2[e]	Polyethylene	100 mL	7 days	Cool to 4°C
Total Recoverable Chromium, Iron and Zinc	SW-846 3005/6010A	Polyethylene	1 liter	180 days	pH <2 with HNO_3 Cool to 4°C
Potentially Dissolved Lead	SW-846 6010A	Polyethylene	1 liter	180 days	pH <2 with HNO_3 Cool to 4°C

[a] Holding time calculated from verified time of sample collection. Holding time for mercury is 28 days.
[b] U.S. Environmental Protection Agency, SW-846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd Edition (EPA, 1990)
[c] EPA SW-846, modified according to the California State Water Resources Control Board, *Leaking Underground Fuel Tank Field Manual, Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure*, Appendix B (1989)
[d] *Resource Conservation and Recovery Act*
[e] U.S. Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes*, (EPA, 1983)

mL = Milliliter(s)
HCl = Hydrochloric acid
H_2SO_4 = Sulfuric acid
HNO_3 = Nitric acid
°C = Degree(s) Celsius

3.0 Analytical Results

The third quarter 1997 analytical results for the pond cleanup COPCs (diesel-range TPH, BTEX, barium, chromium, and lead) for the drilling effluent pond monitoring wells are presented in Table 3-1. Appendix B contains the laboratory report of the results for all analytes for the third quarter of 1997 sampling event. A review of the analytical data for laboratory method blanks was performed to ensure that the COPC concentrations reported for the groundwater samples were representative of groundwater quality rather than laboratory contamination. The following sections provide a discussion of the third quarter 1997 groundwater sampling results.

3.1 BTEX

Benzene and toluene were detected in Well RU-03, but not in any of the other wells. This is the first time these constituents have been detected in a well at the Rulison Site. The source is unknown. The presence of benzene and toluene in Well RU-03 is unrelated to the pond as RU-03 is hydrologically upgradient from the pond. Ethylbenzene and xylene were not detected in any of the groundwater samples from the third quarter 1997 sampling event. There were no data qualifiers for any of the samples.

3.2 Diesel-Range TPH

Diesel-range TPH was not detected in any of the groundwater samples from the third quarter 1997 sampling event.

3.3 Inorganics

The third quarter 1997 samples from all wells contained barium at levels ranging from 114 to 425 micrograms per liter (µg/L). Chromium was detected in two samples, upgradient Well RU-03 (9.8 µg/L) and downgradient Well RU-05 (39.2 µg/L). Chromium was not detected in Wells RU-06A and RU-08. The source of chromium in the groundwater is unknown, but it is suspected that it is naturally occurring in the soils at the Rulison Site. Its presence is not likely to represent migration from the pond sediments. During the second quarter 1997 sampling, arsenic was detected in all of the wells sampled (DOE, 1997); however, during the third quarter 1997 sampling, arsenic was detected in only two of the samples (RU-03 and RU-05). Arsenic was not identified as a COPC for pond cleanup and is likely to be of local natural origin. Lead was detected in three wells, RU-03, RU-05, and RU-08, and also in the equipment rinsate. Lead was not detected in Well RU-06A. Selenium was not detected in any of the samples.

Table 3-1
Rulison Site Groundwater Analytical Results
Third Quarter, 1997 (All results in µg/L)
(Page 1 of 3)

Well	First Quarter 1996	Second Quarter 1996	Third Quarter 1996	Fourth Quarter 1996	First Quarter 1997	Second Quarter 1997	Third Quarter 1997	Fourth Quarter 1997
TPH - Diesel								
RU-03	100U	94U	500U	500U	1000U	1000U	1000U	
RU-05	100UJ[1]	94U	NS	NS	NS	1100U	1000U	
RU-06A	100U	71R	500U	500U	1000U	1000U	1000U	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	100UJ	94U	NS	NS	NS	1300U	1000U	
Benzene								
RU-03	0.5U	0.5U	1U	1U	1U	0.50U	2.5	
RU-05	0.5U	0.5U	NS	NS	NS	0.50U	1.0U	
RU-06A	0.5U	0.5U	1U	1U	1U	0.50U	1.0U	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	0.5U	0.5U	NS	NS	NS	0.50U	1.0U	
Toluene								
RU-03	0.5U	0.5U	1U	1U	1U	1.0U	3.9	
RU-05	0.5U	0.5U	NS	NS	NS	1.0U	1.0U	
RU-06A	0.5U	0.5U	1U	1U	1U	1.0U	1.0U	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	0.5U	0.5U	NS	NS	NS	1.0U	1.0U	
Ethylbenzene								
RU-03	0.5U	0.5U	1U	1U	1U	1.0U	1.0U	
RU-05	0.5U	0.5U	NS	NS	NS	1.0U	1.0U	
RU-06A	0.5U	0.5U	1U	1U	1U	1.0U	1.0U	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	0.5U	0.5U	NS	NS	NS	1.0U	1.0U	

Table 3-1
Rulison Site Groundwater Analytical Results
Third Quarter, 1997 (All results in µg/L)
(Page 2 of 3)

Well	First Quarter 1996	Second Quarter 1996	Third Quarter 1996	Fourth Quarter 1996	First Quarter 1997	Second Quarter 1997	Third Quarter 1997	Fourth Quarter 1997
Xylenes (total)								
RU-03	0.5U	0.5U	1U	1U	1U	1.0U	2.0U	
RU-05	0.5U	0.5U	NS	NS	NS	1.0U	2.0U	
RU-06A	0.5U	0.5U	1U	1U	1U	1.0U	2.0U	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	0.5U	0.5U	NS	NS	NS	1.0U	2.0U	
Barium								
RU-03	120	110	105	135	86	90.3	148.0	
RU-05	360	120	NS	NS	NS	89.8	425.0	
RU-06A	120	120	119	116	118	130	114.0	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	350	140	NS	NS	NS	146	127.0	
Chromium								
RU-03	10U	10U	1.5U	6.7	2.2	5.0	9.8	
RU-05	24	10U	NS	NS	NS	1.8	39.2	
RU-06A	10U	10U	1.5U	1.5U	2.5	1.0U	1.0U	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	10U	10U	NS	NS	NS	3.1	1.0U	
Lead								
RU-03	5.6U	3U	1.5	2.3U	2.0U	2.5	6.4	
RU-05	13U	3U	NS	NS	NS	3.1	18.5	
RU-06A	3U	3U	0.8U	0.8U	2.0U	2.0U	2.0U	
RU-07	NS	NS	NS	NS	NS	NS	NS	
RU-08	12U	3U	NS	NS	NS	3.5	2.5	

Table 3-1
Rulison Site Groundwater Analytical Results
Third Quarter, 1997 (All results in µg/L)
(Page 3 of 3)

Well	First Quarter 1996	Second Quarter 1996	Third Quarter 1996	Fourth Quarter 1996	First Quarter 1997	Second Quarter 1997	**Third Quarter 1997**	Fourth Quarter 1997
					Selenium			
RU-03	*16*	*14*	2.8U	2.8U	4.0U	3.0U	**3.0U**	
RU-05	*7.2*	*6*	NS	NS	NS	3.0U	**3.0U**	
RU-06A	*12*	*20*	2.8U	2.8U	4.0U	3.0U	**3.0U**	
RU-07	*NS*	*NS*	NS	NS	NS	NS	**NS**	
RU-08	*12*	*22*	NS	NS	NS	3.0U	**3.0U**	

Values in italics are for the dissolved fraction
Values in bold are the third quarter 1997 sampling event results

NS = Well dry - no sample collected
U = Analyte not detected above the specified value
R = Quality control indicates that the data are unusable (compound may or may not be present)
J = Reported value is estimated

The relatively high concentrations of barium, chromium, and lead in Well RU-05 are most likely the result of sediment in the water sample. During previous sampling events, Well RU-05 often did not have enough water to sample. During the third quarter 1997 sampling event, Well RU-05 had 1 foot of water in it, the minimum amount of water required in order to sample. When this well was purged it was likely that sediment was stirred up from the bottom of the well and then picked up in the water sample.

There currently are insufficient data to establish concentration trends or to determine whether total barium concentrations in groundwater downgradient from the pond are significantly elevated above background level. Statistical trends will be calculated as data are acquired from additional quarterly groundwater monitoring events.

3.4 Groundwater Flow

Groundwater depth and elevation data for the drilling effluent pond monitoring wells from the third quarter 1997 sampling event are presented in Table 3-2. Based on the groundwater elevation data, it appears that groundwater flow during the third quarter sampling event was generally towards the northwest. Under this flow condition, Well RU-03 is upgradient from the pond, and Wells RU-05, RU-06A and RU-08 are downgradient from the pond. Well RU-05 is also upgradient of Wells RU-06A and RU-08.

Table 3-2
Rulison Site Groundwater Elevations
Third Quarter, 1997

Well	First Quarter 1996	Second Quarter 1996	Third Quarter 1996	Fourth Quarter 1996	First Quarter 1997	Second Quarter 1997	Third Quarter 1997	Fourth Quarter 1997
Depth to Water (from top of casing)								
RU-03	10.56 m (34.65 ft)	6.81m (22.33 ft)	12.94 m (42.44 ft)	12.93 m (42.42 ft)	10.90 m (35.75 ft)	3.82m (12.52 ft)	8.68 m (28.48 ft)	
RU-05	2.35 m (7.71 ft)	1.96 m (6.42 ft)	Dry	Dry	3.05 m [a] (10.0 ft)	1.75 m (5.75 ft)	2.79 m (9.15 ft)	
RU-06A	4.74 m (15.56 ft)	4.38 m (14.38 ft)	5.55 m (18.20 ft)	4.72 m (15.5 ft)	5.66 m (18.56 ft)	3.79 m (12.45 ft)	4.67 m (15.32 ft)	
RU-07	Dry	Dry	Dry	Dry	3.11 m [a] (10.2 ft)	Dry	Dry	
RU-08	1.78 m (5.85 ft)	1.70 m (5.58 ft)	Dry	Dry	2.23 m [a] (7.3 ft)	1.49 m (4.9 ft)	1.84 m (6.04 ft)	
Groundwater Elevation								
RU-03	2444.29 m (8019.33 ft)	2448.05 m (8031.65 ft)	2441.92 m (8011.54 ft)	2441.92 m (8011.56 ft)	2443.96 m (8018.23 ft)	2451.04 m (8041.46 ft)	2446.17 m (8025.5 ft)	
RU-05	2433.95 m (7985.41 ft)	2434.35 m (7986.70 ft)	< 2434.09 m (< 7985.87 ft)	< 2434.09 m (< 7985.87 ft)	2433.26 m (7983.12 ft)	2434.55 m (7987.37 ft)	2433.51 m (7983.97 ft)	
RU-06A	2430.10 m (7972.78 ft)	2430.46 m (7973.96 ft)	2429.30 m (7970.14 ft)	2430.12 m (7972.84 ft)	2429.19 m (7969.78 ft)	2431.05 m (7975.89 ft)	2430.18 m (7973.02 ft)	
RU-07	<2438.22 m (<7999.40 ft) [b]	<2438.22 m (<7999.40 ft) [b]	<2438.22 m (<7999.40 ft) [b]	<2438.22 m (<7999.40 ft) [b]	2438.15 m (7999.17 ft)	< 2438.22 m (< 7999.40 ft)	<2438.22 m (<7999.40 ft)	
RU-08	2429.05 m (7969.33 ft)	2429.13 (7969.60 ft)	< 2429.01 m (< 7969.18 ft)	< 2429.01 m (< 7969.18 ft)	2428.61 m (7967.88 ft)	2429.34 m (7970.26 ft)	2428.99 m (7969.14 ft)	

[a] Well had less than 1 foot of water, so it was not sampled.
[b] Calculated elevation of total depth of Well RU-07 was incorrect in previous reports and has been corrected.

4.0 Quality Control Results

Field and laboratory QC sample requirements and acceptance criteria are specified in the Rulison QAPP (DOE, 1996c). The laboratory narrative for the third quarter sampling analytical results is included in Appendix B and provides a summary of the results for laboratory QC samples required under the various analytical methods used for the project. The following sections describe the results for field QC samples that are not covered by the laboratory narratives because they are not explicit requirements under the analytical methods used, but they are required for field sampling under the Rulison QAPP (DOE, 1996c).

4.1 Field Duplicate Samples

Field duplicate samples are used to monitor the variability associated with sample collection procedures and to provide estimates of the total sampling and analytical precision. A duplicate sample was collected from Well RU-06A during the sampling event. The relative percent differences (RPDs) between analytes detected in the original sample and the same analytes detected in the associated field duplicate sample were calculated and compared against the precision acceptance criteria specified in the Rulison QAPP (DOE, 1996c). The sample and sample duplicate results, calculated RPDs, and precision acceptance criteria are presented in Table 4-1.

Barium was the only analyte detected in the RU-06A sample and the sample duplicate. The Relative Percent Difference for barium was within the precision acceptance criterion of ± 20 percent specified in the Rulison QAPP (DOE, 1996c). Chromium was not detected in either the sample or the duplicate.

4.2 Equipment Rinsate Blank Samples

Equipment rinsate blanks are used to monitor potential cross-contamination associated with inadequate equipment decontamination procedures. At Rulison, new, dedicated, disposable bailers were used at each well, eliminating the possibility of cross-contamination between wells. An equipment rinse blank was prepared using deionized water to rinse a new, dedicated, disposable bailer prior to its use in sampling water from RU-06A. Lead was found in the equipment rinsate blank at 3.5 µg/L, and in Wells RU-03, RU-05, an RU-08. Lead has been detected previously in Wells RU-03, RU-05, and RU-08 with no lead in the rinsate sample. Lead was not found in Well RU-06A or its duplicate. Lead has not been detected previously in Well RU-06A.

Table 4-1
Rulison Site Groundwater Monitoring Program
Duplicate Sample Comparison:
Third Quarter, 1997
(All results in µg/L)

Analyte	Well RU-6A			RPD Acceptance Criterion
	Sample RUW00114	Sample Duplicate RUW00116	RPD[1]	
TPH	1000U	1000U	0	± 40
Benzene	1.0U	1.0U	0	± 11 to 24
Toluene	1.0U	1.0U	0	± 11 to 24
Ethylbenzene	1.0U	1.0U	0	± 11 to 24
Xylenes	2.0U	2.0U	0	± 11 to 24
Arsenic	3.0U	3.0U	0	± 20
Barium	114.0	114.0	0	± 20
Cadmium	1.0U	1.0U	0	± 20
Chromium	1.0U	1.0U	0	± 20
Lead	2.0U	2.0U	0	± 20
Mercury	0.2U	0.2U	0	± 20
Selenium	3.0U	3.0U	0	± 20
Silver	1.0U	1.0U	0	± 20

[1]Relative percent difference

U = Analyte not detected above the specified value

4.3 Trip Blank Samples

Trip blanks are used to monitor potential volatile organic compound (VOC) cross-contamination introduced into VOC sample containers through diffusion during sample shipment and storage. Trip blank samples were placed in each container used for shipping BTEX samples. BTEX compounds were not detected in the trip blank from the third quarter sampling event.

5.0 Summary and Conclusions

The analytical data from the third quarter 1997 groundwater sampling event indicate that migration of contaminants from the drilling effluent pond sediments currently does not appear to be occurring. The following is a summary of the third quarter 1997 groundwater sample results:

BTEX Compounds: Benzene and toluene were detected in upgradient Well RU-03. BTEX compounds were not detected in any other third quarter groundwater samples.

Diesel-Range TPH: Diesel-range TPH was not detected in any of the third quarter groundwater samples.

Inorganics: Barium, chromium, and lead were detected in the third quarter 1997 groundwater samples from the upgradient and downgradient wells. Chromium and lead were not detected in downgradient monitoring well (RU-06A). The relatively high levels detected in RU-05 are most likely naturally occurring and the result of the uptake of sediment into the groundwater sample. Since these COPCs were detected in the upgradient well, its presence is not likely to represent migration from the pond sediments. As discussed in Section 3.3, there currently are insufficient data to establish concentration trends or to determine whether barium concentrations in groundwater downgradient from the drilling effluent pond are significantly elevated above background. Statistical trends will be calculated as data are acquired from additional quarterly sampling events.

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6.0 References

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Appendix A

Purge Water Discharge Permit

STATE OF COLORADO

Roy Romer, Governor
Patti Shwayder, Acting Executive Director
Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80222-1530
Phone (303) 692-2000

Laboratory Building
4210 E. 11th Avenue
Denver, Colorado 80220-3716
(303) 691-4700

Colorado Department
of Public Health
and Environment

March 19, 1996

Mr. Kevin D. Leary
DOE

Subject: Reply to request for addition of source to permit COG-310084.

Dear Mr. Leary:

The Division has received and reviewed your fax of 3/19/96. Since the wells described in your fax are in such close proximity to the pond that the permit was designed to provide dewatering conditions for, the Division
will allow the wells to be dewatered using the same discharge point as described in the permit. Please follow the same conditions and monitoring schedule as described in the permit. The Division realizes that due to the small amount of water in question, the water might not be of sufficient flow to reach the discharge point. Any future purgings of the water from these wells are covered by this letter and the permit noted above as long as the permit remains active and conditions, monitoring schedule and reporting procedure are followed.

Please feel free to call me at (303)+692-3593 with questions or comments.

Sincerely,

Tom

Tom Boyce
Environmental Protection Specialist
Permits and Enforcement
WATER QUALITY CONTROL DIVISION

cc.file

Appendix B

Third Quarter 1997 Analytical Results

Table B-1
Sample Number and Description

Sample Number	Sample Location or Description
RUW00114	Well RU-06A
RUW00115	Trip Blank
RUW00116	Duplicate of RUW00114 at RU-06A
RUW00117	Well RU-03
RUW00118	Equipment Rinsate
RUW00119	Well RU-05
RUW00120	Not Collected - Well RU-07 was dry.
RUW00121	Well RU-08

LAS LABORATORIES

TOTAL PETROLEUM HYDROCARBONS (TPH)
8015M - TPH

Client Sample ID:	RUW00114	LAS Sample ID:	L10351-28
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	26-SEP-97	Analytical Batch ID:	092597-8015-D-1
Date Extracted:	28-AUG-97	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0
		QC Group:	8015M - TPH_52786

SURROGATE	RECOVERY	QC Limits
n-OCTACOSANE	164% *	26-152

CONSTITUENT	CAS NO.	RESULT mg/L	PQL mg/L	DATA QUALIFIER(S)
Diesel Range Organics	TPH	<1.0	1.0	

LAS LABORATORIES

TOTAL PETROLEUM HYDROCARBONS (TPH)
8015M - TPH

Client Sample ID:	RUW00116	LAS Sample ID:	L10351-29
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	26-SEP-97	Analytical Batch ID:	092597-8015-D-1
Date Extracted:	28-AUG-97	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0
		QC Group:	8015M - TPH_52786

SURROGATE	RECOVERY	QC Limits
n-OCTACOSANE	208% *	26-152

CONSTITUENT	CAS NO.	RESULT mg/L	PQL mg/L	DATA QUALIFIER(S)
Diesel Range Organics	TPH	<1.0	1.0	

LAS LABORATORIES

TOTAL PETROLEUM HYDROCARBONS (TPH)
8015M - TPH

Client Sample ID:	RUW00117	LAS Sample ID:	L10351-30
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	26-SEP-97	Analytical Batch ID:	092597-8015-D-1
Date Extracted:	28-AUG-97	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0
		QC Group:	8015M - TPH_52786

SURROGATE	RECOVERY	QC Limits
n-OCTACOSANE	175% *	26-152

CONSTITUENT	CAS NO.	RESULT mg/L	PQL mg/L	DATA QUALIFIER(S)
Diesel Range Organics	TPH	<1.0	1.0	

LAS LABORATORIES

TOTAL PETROLEUM HYDROCARBONS (TPH)
8015M - TPH

Client Sample ID:	RUW00118	LAS Sample ID:	L10351-33
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	26-SEP-97	Analytical Batch ID:	092597-8015-D-1
Date Extracted:	28-AUG-97	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0
		QC Group:	8015M - TPH_52786

SURROGATE	RECOVERY	QC Limits
n-OCTACOSANE	210% *	26-152

CONSTITUENT	CAS NO.	RESULT mg/L	PQL mg/L	DATA QUALIFIER(S)
Diesel Range Organics	TPH	<1.0	1.0	

LAS LABORATORIES

TOTAL PETROLEUM HYDROCARBONS (TPH)
8015M - TPH

Client Sample ID:	RUW00119	LAS Sample ID:	L10351-34
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	26-SEP-97	Analytical Batch ID:	092597-8015-D-1
Date Extracted:	28-AUG-97	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0
		QC Group:	8015M - TPH_52786

SURROGATE	RECOVERY	QC Limits
n-OCTACOSANE	145%	26-152

CONSTITUENT	CAS NO.	RESULT mg/L	PQL mg/L	DATA QUALIFIER(S)
Diesel Range Organics	TPH	<1.0	1.0	

LAS LABORATORIES

TOTAL PETROLEUM HYDROCARBONS (TPH)
8015M - TPH

Client Sample ID:	RUW00121	LAS Sample ID:	L10351-35
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	26-SEP-97	Analytical Batch ID:	092597-8015-D-1
Date Extracted:	28-AUG-97	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0
		QC Group:	8015M - TPH_52786

SURROGATE	RECOVERY	QC Limits
n-OCTACOSANE	184% *	26-152

CONSTITUENT	CAS NO.	RESULT mg/L	PQL mg/L	DATA QUALIFIER(S)
Diesel Range Organics	TPH	<1.0	1.0	

LAS LABORATORIES

P&T GAS/BTEX
P&T GAS/BTEX

Client Sample ID:	RUW00114	LAS Sample ID:	L10351-1
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	27-AUG-97	Analytical Batch ID:	082797-BTEX-GC1-
Date Extracted:	N/A	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0

SURROGATE	RECOVERY	QC Limits
BFB	102%	60-140
1,4-DFB	104%	75-125

CONSTITUENT	CAS NO.	RESULT ug/L	PQL ug/L	DATA QUALIFIER(S)
Benzene	71-43-2	<1.0	1.0	
Toluene	108-88-3	<1.0	1.0	
Ethylbenzene	100-41-4	<1.0	1.0	
m,p-Xylene	136777-61-2	<2.0	2.0	
o-Xylene	95-47-6	<1.0	1.0	

P&T GAS/BTEX
P&T GAS/BTEX

Client Sample ID:	RUW00115	LAS Sample ID:	L10351-4
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	28-AUG-97	Analytical Batch ID:	082797-BTEX-GC1-
Date Extracted:	N/A	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0

SURROGATE	RECOVERY	QC Limits
BFB	98%	60-140
1,4-DFB	104%	75-125

CONSTITUENT	CAS NO.	RESULT ug/L	PQL ug/L	DATA QUALIFIER(S)
Benzene	71-43-2	<1.0	1.0	
Toluene	108-88-3	<1.0	1.0	
Ethylbenzene	100-41-4	<1.0	1.0	
m,p-Xylene	136777-61-2	<2.0	2.0	
o-Xylene	95-47-6	<1.0	1.0	

P&T GAS/BTEX
P&T GAS/BTEX

Client Sample ID:	RUW00116	LAS Sample ID:	L10351-7
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	28-AUG-97	Analytical Batch ID:	082797-BTEX-GC1-
Date Extracted:	N/A	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0

SURROGATE	RECOVERY	QC Limits
BFB	95%	60-140
1,4-DFB	102%	75-125

CONSTITUENT	CAS NO.	RESULT ug/L	PQL ug/L	DATA QUALIFIER(S)
Benzene	71-43-2	<1.0	1.0	
Toluene	108-88-3	<1.0	1.0	
Ethylbenzene	100-41-4	<1.0	1.0	
m,p-Xylene	136777-61-2	<2.0	2.0	
o-Xylene	95-47-6	<1.0	1.0	

P&T GAS/BTEX
P&T GAS/BTEX

Client Sample ID:	RUW00117	LAS Sample ID:	L10351-10
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	28-AUG-97	Analytical Batch ID:	082797-BTEX-GC1-
Date Extracted:	N/A	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0

SURROGATE	RECOVERY	QC Limits
BFB	96%	60-140
1,4-DFB	105%	75-125

CONSTITUENT	CAS NO.	RESULT ug/L	PQL ug/L	DATA QUALIFIER(S)
Benzene	71-43-2	2.5	1.0	
Toluene	108-88-3	3.9	1.0	
Ethylbenzene	100-41-4	<1.0	1.0	
m,p-Xylene	136777-61-2	<2.0	2.0	
o-Xylene	95-47-6	<1.0	1.0	

LAS LABORATORIES

P&T GAS/BTEX
P&T GAS/BTEX

Client Sample ID:	RUW00118	LAS Sample ID:	L10351-19
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	28-AUG-97	Analytical Batch ID:	082797-BTEX-GC1-
Date Extracted:	N/A	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0

SURROGATE	RECOVERY	QC Limits
BFB	94%	60-140
1,4-DFB	102%	75-125

CONSTITUENT	CAS NO.	RESULT ug/L	PQL ug/L	DATA QUALIFIER(S)
Benzene	71-43-2	<1.0	1.0	
Toluene	108-88-3	<1.0	1.0	
Ethylbenzene	100-41-4	<1.0	1.0	
m,p-Xylene	136777-61-2	<2.0	2.0	
o-Xylene	95-47-6	<1.0	1.0	

LAS LABORATORIES

P&T GAS/BTEX
P&T GAS/BTEX

Client Sample ID:	RUW00119	LAS Sample ID:	L10351-22
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	28-AUG-97	Analytical Batch ID:	082797-BTEX-GC1-
Date Extracted:	N/A	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0

SURROGATE	RECOVERY	QC Limits
BFB	99%	60-140
1,4-DFB	108%	75-125

CONSTITUENT	CAS NO.	RESULT ug/L	PQL ug/L	DATA QUALIFIER(S)
Benzene	71-43-2	<1.0	1.0	
Toluene	108-88-3	<1.0	1.0	
Ethylbenzene	100-41-4	<1.0	1.0	
m,p-Xylene	136777-61-2	<2.0	2.0	
o-Xylene	95-47-6	<1.0	1.0	

LAS LABORATORIES

P&T GAS/BTEX
P&T GAS/BTEX

Client Sample ID:	RUW00121	LAS Sample ID:	L10351-25
Date Collected:	21-AUG-97	Date Received:	22-AUG-97
Date Analyzed:	28-AUG-97	Analytical Batch ID:	082797-BTEX-GC1-
Date Extracted:	N/A	Analytical Dilution:	1
Matrix:	Water	Preparation Dilution:	1.0

SURROGATE	RECOVERY	QC Limits
BFB	97%	60-140
1,4-DFB	103%	75-125

CONSTITUENT	CAS NO.	RESULT ug/L	PQL ug/L	DATA QUALIFIER(S)
Benzene	71-43-2	<1.0	1.0	
Toluene	108-88-3	<1.0	1.0	
Ethylbenzene	100-41-4	<1.0	1.0	
m,p-Xylene	136777-61-2	<2.0	2.0	
o-Xylene	95-47-6	<1.0	1.0	

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INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

RUW00114

Lab Name: L.A.S Contract: IT_INTERNA

Lab Code: LOCK Case No.: 822IT_ SAS No.: _____ SDG No.: L10351

Matrix (soil/water): WATER Lab Sample ID: L10351-36_

Level (low/med): LOW Date Received: 08/22/97

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic	3.0	U		P
7440-39-3	Barium	114	B		P
7440-43-9	Cadmium	1.0	U		P
7440-47-3	Chromium	1.0	U		P
7439-92-1	Lead	2.0	U		P
7439-97-6	Mercury	0.20	U		AV
7782-49-2	Selenium	3.0	U		P
7440-22-4	Silver	1.0	U		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: YELLOW Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.: RUW00116

Lab Name: L.A.S_____ Contract: IT_INTERNA

Lab Code: LOCK__ Case No.: 822IT_ SAS No.: _____ SDG No.: L10351

Matrix (soil/water): WATER Lab Sample ID: L10351-37_

Level (low/med): LOW__ Date Received: 08/22/97

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic__	3.0	U		P_
7440-39-3	Barium___	114	B		P_
7440-43-9	Cadmium__	1.0	U		P_
7440-47-3	Chromium_	1.0	U		P_
7439-92-1	Lead____	2.0	U		P_
7439-97-6	Mercury__	0.20	U		AV
7782-49-2	Selenium_	3.0	U		P_
7440-22-4	Silver___	1.0	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

RUW00117

Lab Name: L.A.S_____ Contract: IT_INTERNA

Lab Code: LOCK__ Case No.: 822IT_ SAS No.: _____ SDG No.: L10351

Matrix (soil/water): WATER Lab Sample ID: L10351-38_

Level (low/med): LOW__ Date Received: 08/22/97

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic	6.9	B		P
7440-39-3	Barium	148	B		P
7440-43-9	Cadmium	1.0	U		P
7440-47-3	Chromium	9.8	B		P
7439-92-1	Lead	6.4			P
7439-97-6	Mercury	0.20	U		AV
7782-49-2	Selenium	3.0	U		P
7440-22-4	Silver	1.0	U		P

Color Before: BROWN____ Clarity Before: CLOUDY Texture: _____

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

RUW00118

Lab Name: L.A.S_____ Contract: IT_INTERNA

Lab Code: LOCK__ Case No.: 822IT_ SAS No.: _____ SDG No.: L10351

Matrix (soil/water): WATER Lab Sample ID: L10351-41_

Level (low/med): LOW__ Date Received: 08/22/97

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic	3.0	U		P
7440-39-3	Barium	1.0	U		P
7440-43-9	Cadmium	1.0	U		P
7440-47-3	Chromium	1.0	U		P
7439-92-1	Lead	3.5			P
7439-97-6	Mercury	0.20	U		AV
7782-49-2	Selenium	3.0	U		P
7440-22-4	Silver	1.0	U		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

RUW00119

Lab Name: L.A.S_____ Contract: IT_INTERNA

Lab Code: LOCK__ Case No.: 822IT_ SAS No.: _____ SDG No.: L10351

Matrix (soil/water): WATER Lab Sample ID: L10351-42_

Level (low/med): LOW__ Date Received: 08/22/97

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic__	29.0	_		P_
7440-39-3	Barium___	425	_		P_
7440-43-9	Cadmium__	1.0	U		P_
7440-47-3	Chromium_	39.2	_		P_
7439-92-1	Lead____	18.5	_		P_
7439-97-6	Mercury__	0.20	U		AV
7782-49-2	Selenium_	3.0	U		P_
7440-22-4	Silver___	1.0	U		P_

Color Before: BROWN____ Clarity Before: CLOUDY Texture: _____

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

CLIENT ID NO.

RUW00121

Lab Name: L.A.S_____ Contract: IT_INTERNA

Lab Code: LOCK__ Case No.: 822IT_ SAS No.: _____ SDG No.: L10351

Matrix (soil/water): WATER Lab Sample ID: L10351-43_

Level (low/med): LOW__ Date Received: 08/22/97

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7440-38-2	Arsenic	3.0	U		P
7440-39-3	Barium	127	B		P
7440-43-9	Cadmium	1.0	U		P
7440-47-3	Chromium	1.0	U		P
7439-92-1	Lead	2.5	B		P
7439-97-6	Mercury	0.20	U		AV
7782-49-2	Selenium	3.0	U		P
7440-22-4	Silver	1.0	U		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: _____

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